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**PET imaging of the immune system: immune monitoring at the whole body level.**

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**Public Summary:**

Immunotherapies are designed to activate the immune system to fight cancer. As newer immunotherapies are developed, it is very important to be able to monitor changes in the immune system over time and in a non-invasive manner. Currently, a variety of immunotherapies are being advanced in the preclinical and clinical arenas including cytokine therapies, vaccines, adoptive cellular therapy, and immunoregulatory antibodies. These developments highlight the necessity to use non-invasive imaging techniques to follow the therapeutic site of action, duration of immune response and the response of the tumor. Positron emission tomography (PET) imaging has emerged as a flexible tool which allows the user to assess multiple aspects of the immune response, including the ability to monitor the primary and secondary immune response, particular effector subpopulations of the immune response, and with novel probes, to more selectively monitor the immune response versus the tumor. This review focuses on the use of PET imaging to monitor the dynamic, multicellular and distinct spatiotemporal aspects of immunotherapy for malignancy.

**Scientific Abstract:**

As newer immunotherapies are developed, the necessity to non-invasively and temporally assess the changes in the immune system will be more important. Currently, a variety of cytokine therapies, vaccines, adoptive cellular therapy, and immunoregulatory antibodies are being advanced in the preclinical and clinical arenas. These developments highlight the necessity to use non-invasive imaging techniques to follow the therapeutic site of action, duration of immune response and the response of the tumor. Positron emission tomography (PET) imaging has emerged as a flexible tool which allows the user to assess multiple aspects of the immune response, including the ability to monitor the primary and secondary immune response, particular effector subpopulations of the immune response, and with novel probes, to more selectively monitor the immune response versus the tumor. This review focuses on the use of PET imaging to monitor the dynamic, multicellular and distinct spatiotemporal aspects of immunotherapy for malignancy.

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